

Scope of claims

1. An internal combustion engine equipped with a fuel injection valve provided with a mechanism for adjusting preloading force of valve springs, a needle valve being lifted up against valve spring force by fuel pressure supplied under high pressure from an injection pump to open the injection valve and allow the fuel to be injected into a combustion chamber of the engine through injection openings provided at a nozzle chip end, wherein said fuel injection valve is provided with two needle valve springs and two adjusting screw members each for adjusting the preloading force of each of the adjusting screw members independently.

2. An internal combustion engine equipped with a fuel injection valve provided with a mechanism for adjusting preloading force of valve springs according to claim 1, wherein said two valve springs consisting of a first stage spring and a second stage spring are set to be different in preloading force by means of said two adjusting screw members, a first stage adjusting screw member and a second stage adjusting screw member, respectively, said first stage and second stage springs being disposed tandem along the center axis of the needle valve, said first stage and second stage adjusting screw members being disposed tandem along the center axis of the needle valve.

3. An internal combustion engine equipped with a fuel injection valve provided with a mechanism for adjusting preloading force of valve springs according to claim 2, wherein said first adjusting screw member for adjusting

the preloading force of said first stage spring is connected to an upper support of said first stage spring so that said needle valve is always loaded in its closing direction by said first stage spring, said second stage spring is accommodated in an upwardly open hollow of said first stage adjusting screw member, and said second stage adjusting screw member for adjusting the preloading force of said second stage spring is disposed above said first stage adjusting screw member and connected to said second stage spring so that said needle valve is loaded in its closing direction by said second stage spring after said needle valve is lifted up by a specific lift against the restoring force of said first stage spring.

4. An internal combustion engine equipped with a fuel injection valve provided with a mechanism for adjusting preloading force of valve springs according to claim 2, wherein an annular gap is provided between either a periphery of an upper or lower spring support of said first stage spring and a counter bore for receiving the periphery, and an annular gap is provided between either a periphery of said upper spring support or a lower spring support of said second stage spring and a counter bore for receiving the periphery, thereby accommodating slanting of said first stage and second stage springs respectively.

5. An internal combustion engine equipped with a fuel injection valve provided with a mechanism for adjusting preloading force of valve springs according to claim 3, wherein the lower end of the lower spring support of said

first stage spring is applied against the top end of said needle valve; the upper end of a push rod, its lower end contacting closely to the upper end of the lower spring support of the first stage spring, can come into contact with the lower end of the lower spring support of said second stage spring when said needle valve is lifted up by a specific lift, the upper end of the upper spring support of said first stage spring is applied against the lower end of said first stage adjusting screw member, the upper end of the upper spring support of said second stage spring is applied against the lower end of said second stage adjusting screw member, and further each of the contacting face of the push rod with the lower spring support of the first stage spring and the contacting face of the upper spring support of the second stage spring with the second stage adjusting screw member takes a form of spherical contact face respectively.

6. An internal combustion engine equipped with a fuel injection valve provided with a mechanism for adjusting preloading force of valve springs according to claim 3, wherein the lower end of the lower spring support of said first stage spring is applied against the top end of said needle valve, and the upper end of said push rod comes into contact with the lower end of the lower spring support of said second stage spring in plane surface contact when said needle valve is lifted up by a specific lift.

7. A method of adjusting a fuel injection valve of an internal combustion engine equipped with a fuel injection valve provided with a mechanism for adjusting preloading

force of valve springs, the needle valve being lifted up against valve spring force by fuel pressure supplied under high pressure from an injection pump to open the injection valve and allow the fuel to be injected into a combustion chamber of the engine through injection openings provided at a nozzle chip end, wherein first stage(lower pressure) valve opening pressure is adjusted by changing by means of a first stage adjusting screw member preloading force of a first stage spring incorporated in a valve main body to load a needle valve in its closing direction, and second stage(higher pressure) valve opening pressure is adjusted by changing by means of a second stage adjusting screw member preloading force of a second stage spring incorporated in said valve main body to load said needle valve in its closing direction after said needle valve is lifted up by a specific lift against the restoring force of said first stage spring.

8. A method of adjusting a fuel injection valve of an internal combustion engine equipped with the fuel injection valve provided with a mechanism for adjusting preloading force of valve springs, a needle valve being lifted up against a valve spring force by fuel pressure supplied under high pressure from an injection pump to open the injection valve and allow the fuel to be injected into a combustion chamber of the engine through the injection openings provided at a nozzle chip end, wherein a fuel injection valve constructed such that; said two valve springs consisting of a first stage spring and a

second stage spring are set to be different in preloading force by said two adjusting screw members, a first stage adjusting screw member and a second stage adjusting screw member, respectively, said first stage and second stage springs being disposed tandem along the center axis of the needle valve, said first stage and second stage adjusting screw members being disposed tandem along the center axis of the needle valve; and said first adjusting screw member for adjusting the preloading force of said first stage spring is connected to an upper support of said first stage spring so that said needle valve is always loaded in its closing direction by said first stage spring, said second stage spring is accommodated in an upwardly open hollow of said first stage adjusting screw member, and said second stage adjusting screw member for adjusting the preloading force of said second stage spring is disposed above said first stage adjusting screw member and connected to said second stage spring so that said needle valve is loaded in its closing direction by said second stage spring after said needle valve is lifted up by a specific lift against the restoring force of said first stage spring; is deprived of said second stage spring and its appurtenant members, then first valve opening pressure is adjusted by adjusting the preloading force of said first stage spring by means of said first stage adjusting screw member.